MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2017/2018

BER2094 – ENVIRONMENTAL & RESOURCE ECONOMICS

(All Sections/Groups)

13 OCTOBER 2017
09.00 a.m- 11.00 a.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of **SIX (6)** pages including cover page with Section A and B.
2. Section A consists of **ONE (1)** Case Study. Section B consists of **THREE (3)** Structured Questions.
3. Attempt **ALL** questions.
4. Please write all the answers in the answer booklet provided.
5. The marks distribution for each question is given. Total mark is 100.

SECTION A: CASE STUDY (40%)

The Effect of Climate Change on Rice Production in Malaysia

2016 January 11

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Introduction

The United Nations Millennium Development goals are to reduce hunger and poverty. This was the main reason for the UN declaration of the International Year of Rice in 2004. Rice is the source of more than 500 calories per person per day for over 3 billion people (FAOSTAT). By 2010, world rice consumption was about 53.6 kg per capita an increase of 40% from the late '60s. Furthermore, rice cultivation was the main activity and source of income for more than 100 million households in developing countries in Asia, Africa and Latin America (Nguyen, 2012). On-going research on rice research and development in the 1970s and 1980s enabled global rice production to meet the demand of growing populations. However, in an FAO report published in 2005, world rice production was less than rice consumption (FAO, 2005) as world population growth outpaced rice production growth rate. There are many factors that would affect the production of rice, such as attack by pest and diseases, disasters such as long draught or floods brought about by climate change. This paper aims to discuss the effects of climate change on rice production in Malaysia.

Effect of climate change to crops

Generally known, weather plays a major role in determining crop yields. Environmental stresses such as drought, high temperature and air pollution are major limiting factors to crop productivity in the tropics (Ariffin *et al.*, 2003). The impact of these climatic stresses on crop productivity evaluated using morphological, physcio-biochemical and yield responses indicate that climate change does affect agriculture in Malaysia. Study by Zabawi *et al,* 2010 stated that if rainfall or temperature increased by 15%, rice yield will fall by 80%. Hence, it will be a threat to national food security and the economic contribution from the agricultural sector.

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Effect of climate change to rice production

Literatures were reviewed to evaluate the impact of climate change on rice production in Malaysia. In general, rice production in Malaysia ranged from 3 – 5 MT per hectare, whereas the average potential yield was 7.2 MT per hectare (Singh *et al.*, 1996). However, due to climate change, rice yield declined on a range of 4.6 – 6.1% if temperature increased by 1°C. Study by Vaghefi *et al.*, 2011 estimates the effects of climate change by using the ORYZA 2000 crop model and indicates a reduction of rice yield if CO_2 was increased from 383ppm to 574ppm and temperature was increased by 2°C although doubling the CO_2 concentration (from present level of 340ppm to 680ppm) may offset the detrimental effect of a 4°C increase in temperature on rice production. Another study was by Zabawi *et al.* in 2012 which used the CERES-Rice model in DSSAT on simulating rice yield in the Muda Agriculture Development Area (MADA) granary area. The analysis revealed that by increasing 2°C of temperature, the yield of rice decreased from 5 MT per hectare to 4 MT per hectare. The yield was reduced mainly due to the effect of temperature increase during flowering and grain filling.

As far as food security is concerned, minimizing the climate impact, especially in rice sector, is a must. One of the key actions proposed by the policy was strengthening the adaptation and mitigation measures.

Adaptation to climate change

Part of climate change is the occurrence of extreme events such as droughts or floods. In order to overcome this, or at least offset the effect - varieties that are tolerant to water stress should be developed. Hybrid rice was developed with an estimated potential yield from 4.5 to 6.5 MT/ ha. Though this is lower in the range of 20 – 30% as compared to current lowland varieties grown under flooded conditions, it is still comparable, particularly when they consider the predicted losses due to climate change.

In order to lower the impact, rather than new varieties, climate modelling can be used. Improving the understanding of how local weather pattern change with the global warming would be beneficial to create early warnings systems of extreme weather events. Farmers should be informed and guided on appropriate varieties, their management and how to adapt with changes in climate. However, within any one year, there are limitations on how much adaptation can take place – agriculture is, of course practiced outdoors and weather extremes will have an increasingly detrimental impact on yield.

Considering the importance of water to agriculture, especially rice production, upgrading the non-granary area into a granary area is one option for the government. Government should consider an additional non-granary area to be equipped with recent technologies and upgrade the facilities and infrastructure; for example, the irrigation system which was the most important thing for rice cultivation. Non-granary area, which is not facilitated with proper irrigation system, had a lower average production per hectare, which is at 3.1 MT as compared to the granary area at 4.1MT per hectare (Rozhan *et al.*, 2013).

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Policy Recommendations

To minimize the impact of climate change, government should not just focus on developing the rice varieties, mechanization, and farm management. It should also concentrate on pests and diseases as part of climate change issues. Other than varieties, mechanization and farm management policy, methods of controlling pests and diseases under different environment conditions should be in mind as well.

The El Niño scenario, which occurred in 1997/ 98, caused a long period of drought in Malaysia. During this period rainfall was recorded to be less than 100mm per month. However, the difference of production during the El Niño and previous normal periods were relatively small. The loss was at about 7%. Nevertheless, this was offset by rice production in other areas. For longer periods of drought, technology for water saving will be very important.

As mentioned earlier, new hybrid rice which is tolerant to water stress has already been introduced. However, yield also fell due to excessive rainfall, which implies that development of new varieties that tolerate high rainfall and flooding should be undertaken as well. Establishment of new varieties as everyone knowns, can take many years. For short term solutions, local authorities could consider the benefits (and cost) of upgrading water management capability. As mentioned earlier, policy related to weather information should be established to make sure that farmers are aware of climate change.

Conclusions

Climate change of course is not only something that exists in Malaysia: it is recognized as a global problem and requires a global solution to mitigate the driving greenhouse gas emissions With the increasing likelihood that the accumulating greenhouse gases will change the climate, a consensus has emerged in the international community over the need to stabilize GHG atmospheric concentrations and provide long-term solutions to climate change problem (ADB report, 2009). Researchers have been trying to assess the impact of climate change on crops in order to sustain food supplies. In Malaysia an adaptation strategy, including crop management, soil management and irrigation management was proposed to farmers in order to minimize the impact of climate change.

Based on the above article, answer the following questions:

a) State and discuss any **TWO (2)** effects of climate change on rice production in Malaysia. (10 marks)

b) Based on the article above, explain any **THREE (3)** adaptation measures to climate change on rice production in Malaysia. (12 marks)

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c) State the **THREE (3)** policy recommendations suggested by the author to minimize the impact of climate change on rice production. (6 marks)

d) Suggest a suitable market-based approach for the policy makers to strengthen the adaptation measures of climate change in rice production. Explain. (12 marks)

SECTION B: STRUCTURED QUESTIONS (60%)

QUESTION 1 (20 marks)

a) Using example, distinguish between local pollution and global pollution. (6 marks)

b) Three scientific methods are commonly used to identify health hazard. List and explain the **THREE (3)** scientific methods. (9 marks)

c) State the **TWO (2)** major tasks in responding to an environmental risk. (5 marks)

QUESTION 2 (20 marks)

a) Our ground water and surface water supplies are at risk of overuse in many areas. Some evidence to suggest that consumption of water is sensitive to price. Assume that the market for household drinking water in Area Y is modeled as follows:

$$S = MSC = 10 + 0.2Q \qquad D = MSB = 40 - 0.4Q$$

where, Q is millions of gallons per day and MSC and MSB are in cents per gallon.

i) Based on a flat fee pricing system, calculate the equilibrium amount of water that households in Area Y would use. (4 marks)

ii) If the price of water reflects the true marginal social costs of production, calculate the equilibrium quantity and price to promote water conservation. (6 marks)

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b) Improper cellphone disposal is an ongoing problem and it's a huge issue. Peter is an environmental officer. He is responsible for setting a retail proper disposal charge on cellphone. The following are the estimated marginal benefit and cost functions for cellphone:

$$MPB = 10.0 - 0.5Q \qquad MPC = 1.0 + 0.4Q$$

$$MSB = 10.0 - 1.1Q \qquad MSC = 1.0 + 0.4Q$$

where, Marginal Private Benefit; Marginal Social Benefit; Marginal Private Cost and Marginal Social Cost are measured in dollars per gram, and Q is in kilograms.

i) Develop the Marginal External Benefit (MEB) function and explain the meaning of this function. (2 marks)

ii) Calculate the equilibrium price (P_C) and quantity (Q_C) being exchanged in the cellphone market without government intervention. (2 marks)

iii) Determine the retail disposal charge that will produce an efficient allocation of cellphone. (6 marks)

QUESTION 3 (20 marks)

a) Discuss any **TWO (2)** factors that make oil cartelization possible. (6 marks)

b) Using a suitable diagram, explain Environmental Kuznets Curve (EKC). (6 marks)

c) Distinguish any **FOUR (4)** differences between Pollution Prevention (P2) with Industrial Ecology. (8 marks)

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